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EMC Business Continuity for Microsoft SQL Server 2008

Enabled by EMC Celerra Fibre Channel, EMC MirrorView, VMware Site Recovery Manager, and VMware vSphere 4

Reference Architecture

EMC NAS Product Validation

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Reference architecture overview

Document purpose

EMC's commitment to consistently maintain and improve quality is led by the Total Customer Experience (TCE) program, which is driven by Six Sigma methodologies. As a result, EMC has built Customer Integration Labs in its Global Solutions Centers to reflect real-world deployments in which TCE use cases are developed and executed. These use cases provide EMC with an insight into the challenges currently facing its customers.

This document describes the reference architecture of an EMC Business Continuity for Microsoft SQL Server 2008 enabled by EMC® Celerra® Fibre Channel, EMC MirrorView™, VMware vSphere 4, and VMware Site Recovery Manager solution.

Solution purpose

The purpose of this reference architecture is to build and demonstrate the function, performance, and scalability of a well-performing EMC Business Continuity solution for Microsoft SQL Server 2008.

This reference architecture validates all aspects of the solution and provides guidelines for building similar solutions.

EMC Business Continuity for Microsoft Server 2008 Enabled by EMC Celerra EMC Celerra Fibre Channel, EMC MirrorView, VMware Site Recovery Manager, and VMware vSphere 4 – Proven Solution Guide available on Powerlink® provides comprehensive information about this solution. This is a confidential document available to EMC employees and partners on Powerlink.

The business challenge

Databases are an integral part of virtually every enterprise business. From CRM and human resource systems to payroll, business intelligence, web content and more, designing and building a database infrastructure to support these functions and protect the data it contains is a major challenge.

These systems are always on and being accessed by users, at the same time, holding more and more data. In most cases, it is not acceptable to take the database offline for nightly backups. In the event a restore is required, it must be restored quickly and with minimum impact to users.

In addition, to continue operations in the event of disasters, the data must be replicated to an offsite location that can be brought online quickly, with minimum (sometimes zero) data loss. Together, these challenges demand a solution that offers effective and affordable protection of this critical business function.

The technology solution

It is important to work with an experienced provider of backup and replication solutions – one with a strong record and ability to deliver. EMC provides a range of solutions for companies of all sizes. With EMC Information Lifecycle Management (ILM), the level of protection can be increased as requirements change and businesses grow.

EMC has designed solutions for protecting Microsoft SQL Server 2008 database environments using EMC and VMware software and EMC Celerra unified storage platforms.

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This solution demonstrates how the EMC Celerra unified storage platform in conjunction with VMware vSphere 4 can be used to design a robust Microsoft SQL Server 2008 environment. In this solution, a NetWorker® server and the NetWorker Module for Microsoft Applications (NMM) create disk-based backups of the SQL Server database on a Celerra CIFS share.

EMC MirrorView in conjunction with VMware Site Recovery Manager (SRM) is used to provide disaster recovery with minimum data loss and quick recovery time for the SQL Server virtual machine.

The solution benefits

Reduces the number of physical servers: Using VMware to virtualize servers helps in reducing the number of physical servers required in an environment, while improving the manageability and flexibility of the SQL Server environments. The tested architecture requires four servers.

- Primary SQL server
- Testing and Development SQL server
- Replication Manager server
- NetWorker server

By leveraging virtualization in the environment all of these roles were achieved using only two physical servers.

Protects SQL databases against data loss: EMC MirrorView provides end-to-end data protection by replicating the contents of the primary volume to secondary volume(s) that reside on a remote storage array. The secondary volumes can be used for a wide range of functions. These include:

- Run reports with no impact to the production system.
- Back up data with no additional impact to the production system.
- Recover from disasters using secondary volumes.

Depending on customer requirements the secondary volumes can be configured for scheduled updates, or to remain synchronized at all times, which eliminates data loss in the event of a disaster.

Accelerates and simplifies the recovery process: VMware Site Recovery Manager enables the design of an effective and automated disaster recovery solution. It accelerates the recovery of the SQL environment by fully automating the process. It simplifies the recovery by eliminating the complex manual steps and centralizing the management of recovery plans.

Quickly test changes using production data: EMC SnapView™ used with EMC Replication Manager allows database administrators to quickly create point-in-time views of the database. These can be modified for testing without impacting the actual production data, which is still online. These point-in-time views, or snapshots, can usually be created and ready for use on a separate system within a few minutes.

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Solution architecture

Architecture diagram

The following illustration shows the overall physical architecture of the solution.
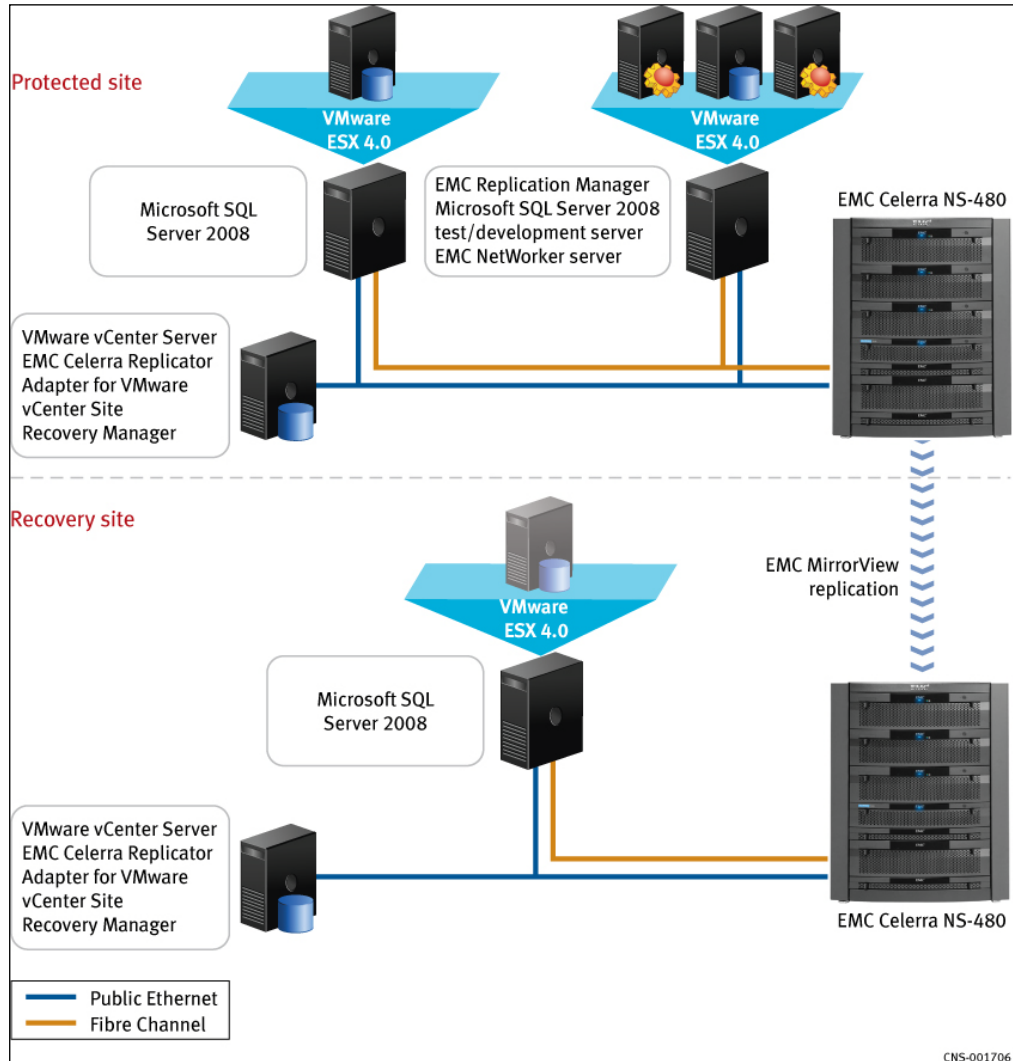
Reference architecture overview

The validated solution is built with a virtualized SQL Server 2008 environment on EMC Celerra unified storage platforms.

The key components of the reference architecture are:

- Microsoft SQL Server 2008
- EMC Celerra unified storage platforms
- VMware vSphere4
- EMC NetWorker server
- EMC Celerra deduplication
- EMC MirrorView
- VMware vCenter Site Recovery Manager (SRM)

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- EMC Replication Manager

Microsoft SQL Server 2008 is installed on a VMware ESX 4.0 virtual machine. The EMC Replication Manager server, Testing and Development SQL server, and EMC NetWorker server are created on another VMware ESX 4.0 server.

An EMC Celerra unified storage platform is used to store the production database, log files, and database backups. A second Celerra unified storage platform is used as a replication target for the production.

EMC MirrorView in conjunction with VMware SRM is used to provide the disaster recovery of a SQL Server environment.

The following are the different connectivity methods used in the solution:

- The SQL database drives are accessed by the SQL servers using the FC protocol.
- The backup target is a CIFS share accessed through a CIFS share.

Storage layout   The following illustration shows how the storage is provisioned in one possible configuration of the validated solution.
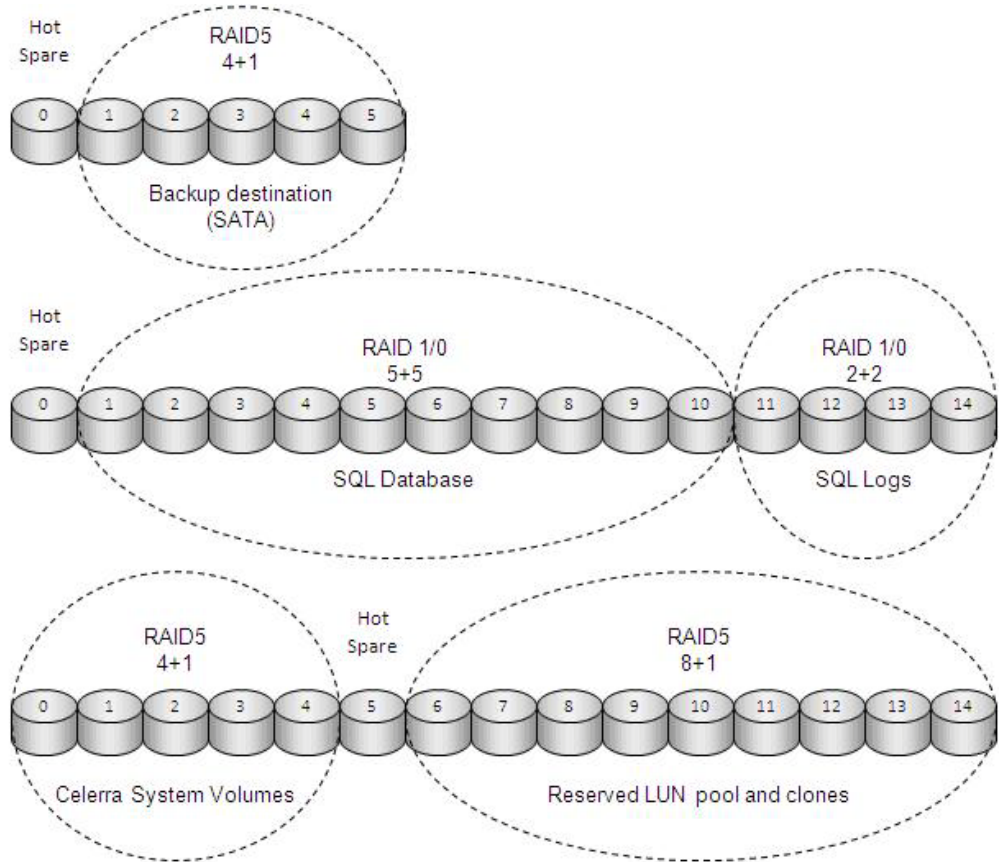
Storage layout overview   The validated solution uses storage through the Fibre Channel (FC) and Common Internet File System (CIFS) protocols. The FC protocol is used to provide storage for

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SQL database and log files. The CIFS protocol provides access to the area used for database backups.

To satisfy the performance requirements and to enable the use of several array-based functions, the validated solution specifies that the primary database should reside on FC storage. The validated solution uses 14 spindles to host database and transaction logs. For high performance, the protection level used is RAID 1/0. The CIFS area in Celerra provides the space to accommodate full, differential, and transactional log backups as required. Five low-cost, low-power SATA drives with a RAID 5 protection level are used for the CIFS area.

A RAID 5 (8+1) group accommodates the space for the clones, the snapshots, and the reserved LUN pool.

Network layout   The following illustration shows the ports on the EMC Celerra NS-480.
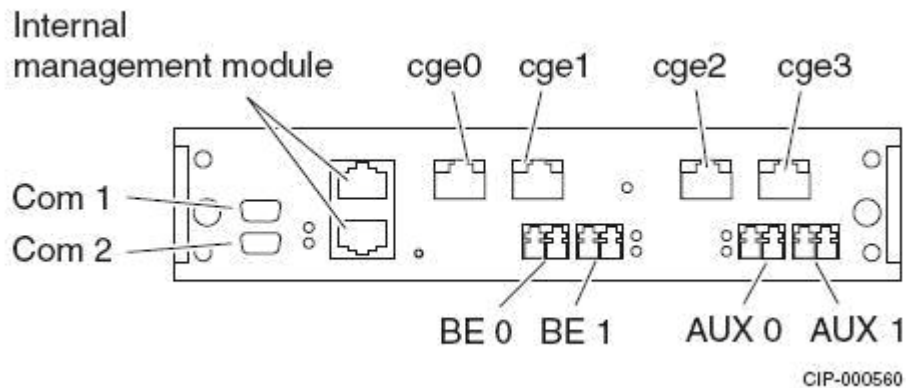
Network layout overview   The EMC Celerra NS-480 storage array contains at least two Data Movers, which can operate independently. Each Data Mover has a minimum of four Ethernet ports. Port cge0 is used for the CIFS traffic and the other ports are left open for future requirements.

The EMC Celerra NS-480 comes with an integrated CLARiiON® CX4 storage array, which has two storage processors (SPs). Each of these SPs contains a minimum of four 4 Gb/s Fibre Channel front-end ports, which can be expanded by adding extra I/O modules. These front-end ports can be connected to a SAN switch or directly connected to a host bus adapter (HBA) on the host. The validated solution uses a SAN switch for FC connectivity among the storage array and servers. Port0 and port1 on each SP are used to connect to the Celerra Data Movers. Port2 and port3 are used for host/server connectivity and port7 on each SP is used for MirrorView replication.

Key components

Introduction   This section briefly describes the key components of this solution.

Hardware and software resources provides details on all the components that

constitute the reference architecture.

EMC Celerra unified storage platforms

EMC Celerra unified storage platforms are dedicated network servers that are optimized for file and block access, delivering high-end features in a scalable, easy-to-use package. For the ultimate in scalability, the Celerra unified storage platforms leverage both the innovative EMC CLARiiON Fibre Channel RAID storage, delivering best-in-class availability and data protection, and industry-leading EMC Celerra availability, performance, and ease of management.

Celerra unified storage platforms deliver a single-box block and file solution offering a centralized point of management for distributed environments. This makes it possible to dynamically grow, share, and cost-effectively manage multi-protocol file systems and also provide multi-protocol block access. Administrators can take advantage of simultaneous support for NFS and CIFS protocols by enabling Windows and Linux/UNIX clients to share files by using the Celerra system's sophisticated file-locking mechanisms and by leveraging iSCSI or Fibre Channel for high-bandwidth or latency-sensitive applications.

While the FC network can be used for the SQL database and logs, the IP infrastructure is used for backup data storage, providing a one-stop solution for all SQL storage needs.

Celerra unified storage platforms provide native CLARiiON value-added functionality such as MirrorView/S, MirrorView/A, SnapView snapshots and clones. MirrorView can be used for replicating and protecting the SQL production databases and SnapView can be used for taking a point-in-time view and full copy of the production databases.

VMware vSphere 4

The new VMware vSphere 4 provides significant performance enhancements that make it easier for organizations to virtualize their most demanding and intense workloads.

vSphere 4 includes an ESX 4.0 hypervisor and the vCenter management interface. VMware ESX 4.0 can transform or virtualize the hardware resources of an x64-based computer, including the CPU, RAM, hard disk and network controller, to create a fully functional virtual machine that can run its own operating system and applications just like a physical computer.

EMC NetWorker   EMC NetWorker provides the ability to protect an enterprise against data loss. As the enterprise grows, so does the complexity and importance of protecting data. NetWorker provides the power and flexibility to meet these challenges.

NetWorker is a cross-platform, client-server application that provides the ability to remotely manage all NetWorker clients and servers from a web-enabled, graphical interface. The NetWorker server backs up client data regularly by using scheduled backups. Scheduled backups are preferred over the manual backups because they occur automatically, and data can be recovered more easily. Scheduled backups can also be started at any time.

EMC Celerra deduplication   Celerra deduplication is designed to improve storage efficiency by reducing storage needs intelligently. Celerra deduplication combines file-level single instancing and file-level compression into one feature. This feature reduces the cost of storing the data on a NAS file system by automatically targeting files that are the best candidates for compression and single instancing in terms of level of frequency of file access and file size. It filters files that are too small, too big, and accessed too often from being processed.

EMC MirrorView   EMC CLARiiON MirrorView is a storage-based disaster recovery (DR) product that provides end-to-end data protection by replicating the contents of the primary volume to a secondary volume that resides on a different CLARiiON storage system. MirrorView offers the following two complementary, but separately licensed-storage system-based mirroring products:

- MirrorView/Synchronous (MirrorView/S)
- MirrorView/Asynchronous (MirrorView/A)

MirrorView/S is a synchronous product that mirrors data in real time between local and remote storage systems. In this model, each server write on the primary side is written concurrently to the secondary site. The primary benefit of this model is that its recovery point objective (RPO) is zero because the transfer of each I/O to the secondary side occurs before an acknowledgement is sent to the server.

MirrorView/A is an asynchronous product that offers extended-distance replication based on a periodic incremental-update model. It periodically updates the remote copy of the data with the changes that occurred on the primary copy since the last update.

Features such as consistency groups allow applications that are write-order dependent across volumes to manage several volumes as one volume. Data replication is supported over storage area networks (SANs) and IP extended SAN environments.

VMware vCenter Site Recovery Manager (SRM)	VMware vCenter Site Recovery Manager is a framework that integrates with various EMC replication software products such as MirrorView for CLARiiON to automate the failover process of virtual machines. SRM Recovery Plans leverage the array-based snapshot features to test the failover process to ensure that the secondary image is consistent and usable. SRM relies on two independent VMware vCenter servers at both the protected (primary) site and at recovery (secondary) site to facilitate the failover process between the two sites. Array-based Storage Replication Adapters (SRAs) are also installed at both sites to communicate to the storage systems independently. SRA is a software provided by storage vendors that ensures the integration of storage devices and replication with VMware SRM.

EMC Replication Manager	EMC Replication Manager is a replica automation software that creates point-in-time replicas of databases and file systems residing on CLARiiON, Symmetrix®, or EMC Celerra unified storage platforms. Replicas can be used for repurposing, backup and recovery, or part of a disaster recovery plan. RM provides a single interface to manage the local and remote replicas across supported storage systems. Replication Manager supports SnapView snapshots and clone replicas of MirrorView/S or MirrorView/A primary images.

Validated environment profile

Profile characteristics	The solution was validated with the following environment profile.

Profile characteristic	Value
SQL 2008 database size	200 GB
Instances and databases	Single instance and single database
Number of database files	Four files each on a different LUN
Workload	OLTP
Storage for SQL database	FC storage
Storage for SQL backups	CIFS share
Production SQL 2008 databases RAID type, physical drive size and speed	RAID 1/0, 300 GB, 15k rpm FC disks
Backup area RAID type, physical drive size and speed	RAID 5, 1 TB, 7.2k rpm SATA disks

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Hardware and software resources

Hardware   The following table lists the hardware used to validate the solution.

Equipment	Quantity	Configuration	Purpose
Storage	2	EMC Celerra NS-480 CLARiiON CX4-480 Two Data Movers 30k to 15k rpm FC drives (300 GB) 6k to 7.2k rpm SATA drives (1000 GB)	One at the primary site and another at the secondary site.
Enterprise Class Fibre Channel switch	2	4 GB Fibre Channel switch	One at the primary site and another at the secondary site.
Enterprise network switch	2	Gigabit Ethernet switch	One at the primary site and another at the secondary site.
HP Proliant DL585 D5 Server	2	4 Quad-Core 2.31 Ghz AMD Opteron processors, 72 GB RAM, four 1 Gigabit Ethernet adapters, two FC HBAs	ESX 4.0 server, which hosts the SQL Server VM with four vCPUs and 16 GB RAM. (One at the primary site and another at the secondary site.)
Dell PE 2950	2	2 Quad-Core 3 Ghz Intel Xeon processors, 16 GB RAM, 4 NICs	VMware vCenter Server installed with VMware Site Recovery Manager and Storage Replication Adapter. (One at the primary site and another at the secondary site.)
HP Proliant DL385 D5 Server	2	2 Quad-Core 3 Ghz Intel Xeon processors, 20 GB RAM	ESX 4.0 servers, which host utility, test/dev and application server VMs (Load generation, SQL Server 2008 test/dev machine, Replication Manager, NetWorker server)

Software   The following table lists the software used to validate the solution.

Software	Version
VMware vSphere	4.0
Microsoft Windows Server	Windows 2008 x64 Enterprise Edition SP2 Windows 2003 x32 Enterprise Edition R2 SP2
Microsoft SQL Server	SQL Server Enterprise Edition 2008 SP1
EMC Celerra DART	5.6.46.4
EMC CLARiiON FLARE®	04.28.000.5.706
VMware Site Recovery Manager	4.0.0
EMC MirrorView Storage Replication Adapter	1.4.0.15
EMC Solutions Enabler	7.0.1.0
EMC Replication Manager	5.2.2
EMC NetWorker	7.5 SP1
EMC NetWorker Module for Microsoft Applications	2.2

Conclusion

Summary
Building an enterprise SQL Server environment that encompasses local backup and remote site disaster recovery is a complicated endeavor. This reference architecture provides a validated business continuity solution for Microsoft SQL Server 2008 by using EMC Celerra unified storage platforms, VMware vSphere 4.0, NetWorker, Celerra deduplication, MirrorView, Site Recovery Manager (SRM) and Replication Manager, and provides the following benefits:

Reduces the number of physical servers: Using VMware to virtualize an environment helps in reducing the number of physical servers required, while improving the manageability and flexibility of the SQL Server environments.

Simplifies the backup management and improves storage efficiency: EMC NetWorker with the NetWorker Module for Microsoft Applications (NMM) reduces the complexity of backup management by centralizing and scheduling the SQL database backups. EMC Celerra deduplication helps in reducing the storage footprint for SQL backups.

Protects SQL databases against disasters: MirrorView provides end-to-end data protection by replicating the contents of the primary volume to secondary volume(s) that reside on remote storage array(s).

Accelerates and simplifies the recovery process: VMware Site Recovery Manager enables the design of an effective and automated disaster recovery solution. It accelerates the recovery of the SQL environment by fully automating the process. It simplifies the recovery by eliminating the complex manual steps and centralizing the management of recovery plans.

Provisions a quick test/dev environment: EMC SnapView and clone functionality help in quickly provisioning a test/dev environment or re-purposing a database with no impact on production.

Next steps
EMC can help accelerate assessment, design, implementation and management, while lowering the implementation risks and costs of a backup/disaster recovery solution for a Microsoft SQL Server 2008 environment.

To learn more about this and other solutions, contact an EMC representative.